## Claims

1. A quality-of-service (QoS) reservation method for managing
network resources and/or service parameters needed for sym-
metric real-time multimedia applications and/or data services
running on a mobile node (106a) and a correspondent node
(106c) by signaling resource control information along spe-
cific routing paths between these nodes (106a, 106c),
said method comprising the steps of

   - embedding (S1) resource control information to be transmit-
     ted between the mobile node (106a) and the correspondent
     node (106c) in an message (400) which is sent via the rout-
     ing path of the reserved connection for these nodes
     (106a+c) and

   - disseminating (S2) resource control information between the
     mobile node (106a) and the correspondent node (106c) by us-
     ing the same routing path (alternative #1) through the net-
     work (104) in both directions.

2. A method according to claim 1,
characterized in that
the mobile node (106a) initiates (S3a) a resource reservation
request message indicating the demand for a predefined amount
of network resources simultaneously for both directions.

3. A method according to claim 1,
characterized in that
the correspondent node (106c) initiates (S3b) a resource res-
ervation request message indicating the demand for a prede-
fined amount of network resources simultaneously for both di-
rections.

4. A method according to anyone of the claims 2 or 3,
characterized in that

the initiator (106a/c) of the resource reservation request
message generates (S4) a unique reservation identifier (ID)
associating the bidirectional connection to achieve a spe-
cific forwarding behaviour which remains unchanged during the
5   lifetime of the associated flow.


5. A method according to anyone of the claims 2 to 4,
characterized by the following steps:
– allocating (S5) network resources by using resource control
10   information piggy-packed in an IP datagram (400),
– monitoring (S6) these network resources or
– simultaneously doing both (S5+S6) at the same time for both
     directions of the resource reservation request message,
wherein resource control information for both directions of
15  the reserved routing path is embedded in the same IP datagram
    (400).


6. A method according to anyone of the preceding claims,
characterized in that
20  resource control information for each direction of a reserva-
tion is piggybacked (S7) via resource information elements
(400a+b) that are a part of the header extension (401c+d,
401c'+d') of the IP datagram (400), wherein each resource in-
formation element (400a+b) represents either a resource at-
25  tribute along the reserved routing path, associated with a
quantifiable resource metric for either one or both direc-
tions of the flow, or a flow attribute for an individual flow
or flow aggregate, associated with quantifiable and non-
quantifiable flow context information either for one or both
30  directions of the flow.


7. A method according to claim 6,
characterized in that
said resource information elements (400a+b) describe resource
35  control information for upstream direction from the initiator

towards the receiver or downstream direction from the re-
ceiver towards the initiator of a resource reservation re-
quest message or for both directions together, wherein up-
stream and downstream direction are uniquely identified by
5    the mobile node (106a) and the correspondent node (106c) due
to their role in the reservation procedure either as initia-
tor or receiver of a resource reservation request message.


8. A method according to claim 6,
10   characterized in that
said resource information elements (400a+b) are organized in
a modular fashion for each flow, wherein the node (106a or
106c) that originates the resource control information deter-
mines (S8) the number of resource information elements
15   (400a+b) to be placed into an IP datagram header (401c+d,
401c'+d').


9. A method according to anyone of the preceding claims,
characterized in that
20   each resource information element (400a+b) comprises a field
(503) for the monitored attribute value and attribute re-
quirement specification fields (504, 505) specifying re-
source-attribute-specific flow requirements, which are de-
scribed by an upper threshold defining the maximum value
25   and/or a lower threshold defining the minimum value for the
respective resource attribute.


10. A method according to anyone of the preceding claims,
characterized by the following steps:
30   - simultaneously monitoring (S9a) information about available
resources for both directions of the reservation along the
reserved routing path (alternative #1) between the mobile
node (106a) and the correspondent node (106c),

- for every node (105b+c) along the reserved routing path
  (alternative #1), determining (S9b) actual resource attrib-
  ute values for up- and downstream direction,
- if at any node (105b+c) along the reserved routing path
  (alternative #1) a monitored resource attribute either for
  up- or downstream direction or for both directions has a
  value which is less than the correspondent monitored at-
  tribute value that is carried in the IP datagram header,
  assigning (S9c) the new value to the resource information
  element (400a/b) of the IP datagram header, which enables
  the receiver of the resource control information to deter-
  mine (S9d) current resource values for both directions.


11. A method according to anyone of the preceding claims,
characterized by the following steps:
- sending (S10a) a resource reservation request message de-
  scribing a set of attribute requirement specifications and
  controlling (S10b) the resource allocation procedure either
  for one or both directions of the resource reservation by
  either the mobile node (106a) or the correspondent node
  (106c),
- based on such a resource reservation request message, de-
  termining (S10c) resource attribute values that should be
  allocated for the upstream direction, the downstream direc-
  tion or both directions at the same time by every forward-
  ing node (105b+c) along the reserved routing path
  (alternative #1).


12. A method according to anyone of the preceding claims,
characterized in that
resource control information for different bidirectional
flows is piggy-packed (S11a) in the same IP datagram (400),
wherein for each flow a reservation identifier information
element referring to additional flow and resource information
elements (400a+b) in the header of the IP datagram (400) is

attached (S11b) to the IP datagram header and the grouping of reservation identifiers and other resource information elements (400a+b) determines (S11c) the membership of this information to a specific flow.

13. A method according to anyone of the preceding claims, characterized in that
either the mobile node (106a) or the correspondent node (106c) determines (S12) on the IP layer whether bidirectional or unidirectional resource control information can be inserted into an IP datagram (400) that is ready to be transmitted to the networking interface or whether a separate IP datagram (400) needs to be generated for that purpose.

14. A method according to claim 13,
characterized in that
resource control information is placed in any IP datagram (400) which follows the reserved routing path (alternative #1) between the initiator and the receiver of a resource reservation request message.

15. A method according to anyone of the preceding claims, characterized by the step of
recognizing (S13a) conditions of insufficient resources along the routing path for upstream and downstream direction at the correspondent node (106c) by comparing (S13b) monitored attribute values with the attribute requirement specifications in the resource information elements (400a+b) of an arriving IP datagram (400).

16. A method according to anyone of the preceding claims, characterized by the step of
setting (S14) monitored resource attribute values of specific resource information elements specified in the IP datagram

header (400) to zero in case one or more forwarding nodes
(150b+c) do not support these resource attributes.

17. A method according to anyone of the preceding claims,
characterized by the step of
setting (S15) those attribute values carried in the IP data-
gram header to zero that enable reservation end points to
easily interpret the situation of routing asymmetry if up-
and downstream path for a bidirectional reservation do not
follow identical routes at a specific routing node (105b/c)
along the reserved routing path (alternative #1).

18. A method according to anyone of the preceding claims,
characterized by the steps of
- interpreting (S16a) resource reservation request messages
  with the value zero for one or more attribute requirement
  specifications as explicit release messages by the forward-
  ing nodes (105b+c) along the reserved routing path
  (alternative #1) and by the initiator or receiver of the
  resource reservation request messages and
- associating (S16b) the values of these attribute require-
  ment specifications with the removal of flow-specific res-
  ervation state information in the forwarding nodes (105b+c)
  along the reserved routing path (alternative #1).

19. A method according to anyone of the preceding claims,
characterized by the steps of
- interpreting (S17a) resource reservation request messages
  with a value unequal to zero for one or more attribute re-
  quirement specifications as explicit setup messages by the
  forwarding nodes (105b+c) along the reserved routing path
  (alternative #1) and by the receiver (106c) of the resource
  reservation request messages and
- associating (S17b) the values of these attribute require-
  ment specifications with the installation of flow-specific

reservation state information in the forwarding nodes
(105b+c) along the reserved routing path (alternative #1).

20. A method according to anyone of the preceding claims,
characterized by the steps of
- piggy-packing (S18a) a flow information element specifying
  the type of reservation as either bidirectional or unidi-
  rectional in the IP datagram header (401c+d, 401c'+d') of a
  reservation setup message,
- interpreting (S18b) this flow information element at the
  forwarding nodes (105b+c) along the reserved routing path
  (alternative #1) to ensure correct installation of reserva-
  tion state information.